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DOCUMENT-IDENTIFIER: US 20030048106 A1  
TITLE: Modular electronic battery tester

Abstract Paragraph (1):

An electronic battery tester is provided for testing storage batteries. Battery test circuitry is configured to couple to the storage battery and measure a condition of the battery. A removable module is configured to couple to the battery tester to add increased functionality.

Summary of Invention Paragraph (7):

[0005] An electronic battery tester is provided for testing storage batteries. Battery test circuitry is configured to couple to the storage battery and digital processor determines a condition of the battery using the battery test circuitry. A data bus couples to the digital processor and is configured to carry data. A connector couples to the data bus and is configured to receive a removable digital module. The connector includes electrical connections which couple the data bus to the removable module.

Brief Description of Drawings Paragraph (2):

[0006] FIG. 1 is a simplified block diagram of a battery tester and a removable module.

Brief Description of Drawings Paragraph (3):

[0007] FIG. 2 is a more detailed block diagram of the removable module shown in FIG. 1.

Brief Description of Drawings Paragraph (4):

[0008] FIG. 3 is an electrical schematic diagram showing electrical lines or connections in the connector which couples the battery tester to the removable module illustrated in FIG. 1.

Detail Description Paragraph (2):

[0009] The present invention provides an electronic battery tester for testing storage batteries in which removable modules can be selectively coupled to the electronic battery tester to extend the functionality of the device. In various aspects, the invention includes an electronic battery tester adapted to couple to a removable module, a removable module itself and a combination of an electronic battery tester and a removable module. The following is a more detailed description of the invention. However, in broad aspects, the present invention is not limited to the specific configurations or example modules set forth herein.

Detail Description Paragraph (5):

[0012] In accordance with the present invention, a data bus 160 is provided which couples processor 140 to a connector 162. The data bus 160 can carry digital or analog data along with analog signals or electrical power as desired. Connector 162 is configured to couple to a removable module 164 which can be selectively coupled to battery tester 100 to add functionality to battery tester 100.

Detail Description Paragraph (6):

[0013] FIG. 2 is a simplified block diagram of one example of a removable module 164 and shows various component blocks which can be included in module 164. Module 164 includes a connector 180 configured to mate with connector 162 of battery tester 100 and thereby provide a connection to data bus 160. In one aspect, optional digital

circuitry 182 is provided and coupled to data bus 160 through connectors 180 and 162. Similarly, in another example aspect, optional analog circuitry 184 is provided and can also couple to data bus 160 through connectors 180 and 162. Another optional circuit is illustrated as input/output circuit 186 which can couple to data bus 160 through connectors 180 and 162. Removable module 164 can include any combination of circuits 182, 184 and 186. Further, these circuits can optionally interconnect with one another.

Detail Description Paragraph (14) :

[0021] Module 164 can comprise a hybrid vehicle interface. For example, instead of scaling a 42 volt battery voltage, a much high voltage can be scaled such as those present in hybrid vehicles, for example 250 to 400 volts.

Detail Description Paragraph (21) :

[0028] Removable module 164 can also provide a backup battery connection for operating circuitry of battery tester 100. A barcode reader can be included in module 164 such that module 164 can be used to read bar code information, for example on a vehicle or on a battery. This information can be used by the battery tester 100 or stored for future use. A data port can be included in module 164, such as a USB port or a PCMCIA port. This allows the battery tester 100 to couple to widely available modular devices used with personal computers. The module 164 may contain additional memory for storage or data logging or a real time clock.

Detail Description Paragraph (23) :

[0030] Removable module 164 can be coupled to measure battery tester 100 using any appropriate technique. For example, FIG. 4A is a side view showing battery test module 164 coupling to battery tester 100 through screws 300 and 302. Finger grips 304 and 306 can be used to manually tighten the screws 300, 302, respectively, by an operator. FIG. 4B is a side view shown another attachment technique in which a spring loaded members 310 includes a protrusion 312 which fits into a receptacle 314. A more detailed view is shown in the cross-sectional view of FIG. 4C. Other attachment techniques include separate screws or attachment elements, snap fit techniques, etc. The mechanisms can be separate elements, molded into the cases of battery tester 100 and/or removable module 164, etc.

**CLAIMS:**

1. An electronic battery tester testing a storage battery comprising: first and second Kelvin connections configured to electrically couple to the battery; a forcing function source configured to apply a forcing function signal to the battery through the Kelvin connections; a response sensor electrically coupled to the battery through the first and second Kelvin connections configured to measure a response of the battery to the forcing function signal; a data bus coupled to the microprocessor configured to carry data in the electronic battery tester; a connector coupled to the data bus and configured to receive a removable digital module, the connector including electrical connections which couple the data bus to the removable module; and a microprocessor coupled to the response sensor configured to determine a dynamic parameter of the battery as a function of the measured response of the battery to the forcing function signal, the microprocessor configured to couple to the removable digital module and send or receive digital data from the removable digital module on the data bus.

13. The apparatus of claim 1, wherein the microprocessor is configured to receive data from a vehicle through a connection in the removable module.

15. The apparatus of claim 1, wherein the microprocessor is configured to receive software from the removable module through the data bus.

16. The apparatus of claim 1, wherein the microprocessor is configured to receive a software key from the removable module through the data bus.

17. The apparatus of claim 1, wherein the microprocessor is configured to calibrate measurements by coupling to a calibrated reference in the removable module.

18. A removable module configured to couple to the data bus through the connector of

the battery tester of claim 1.

30. The apparatus of claim 18 including a screw configured to attach the removable module to the battery tester.

31. The apparatus of claim 18 including a latch to attach the removable module to the battery tester.

32. The apparatus of claim 18 wherein the removable module includes circuitry configured to scale a test measurement.